Training sessions of volunteer dairy farmers during the workshops lauching the 2024 campaign of experimentation of agroecological technologies

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Contents

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1. Introduction

In systems oriented towards dairy production, forage biodiversification, crop-livestock interaction and co-product recycling are key agroecological factors that can combat low cow productivity and the seasonality of milk production (Sib et al., 2017; Vall et al., 2021; Sodre et al., 2022; Vall et al., 2023).

In 2023, as part of the Initiative on agroecology project, a loop and cascade approach to action on dairy farms was implemented to co-design more agroecological dairy farming systems with dairy farmers in Burkina Faso. An On-farm Experimental Design for Agroecology (OnEDA ; Dispositif Expérimental Agroécologique en Milieu Paysan – DEAMP in french) was set up with volunteer farmers. The OnEDA consisted of: 1) a forage and seed production system called Fodder Demo-Plot (FDP); 2) advice on the rational management of the farm's plant and animal co-products using the *CoProdScope* tool (Zoungrana et al., 2023); 3) advice on dairy cow ration management using the *Jabnde* tool implemented in Dairy Production Workshops using FDP fodder and 4) Efficient Covered Manure Pits with monitoring of the recycling of animal and plant co-products from production and the use of organic manure.

During the first experimentation campaign (2023/2024), seventy-two (72) volunteer farmers (57 dairy farmers and 15 farmers) were identified to set up Fodder Demo-Plots. At the end of the experiment, we counted 65 volunteer farmers (54 dairy farmers and 11 farmers) who were able to implement at least one Fodder Demo-Plot crop, i.e. a completion rate of 90.28%. Dairy farmers implemented an area of 0.76 ± 0.73 ha/FDP and farmers an area of 0.99 ± 0.58 ha/FDP. The various crops planted were maize and sorghum for cereals, cowpea and mucuna for legumes.

The principle of the Fodder Demo-Plot is to dedicate 2/3 of the cultivated area of each crop to forage production and the remaining 1/3 to seed production. The seed produced is divided into three equal parts: one part is used to replicate the Fodder Demo-Plot in year N+1 (2024) by the volunteer farmer (Mother), and the other two parts are given free of charge to volunteer neighbors (Babies) to implement the Fodder Demo-Plot on their farms in year N+1. This principle of seed redistribution was chosen because, in theory, it will enable the practice of forage cultivation to spread rapidly (Theoretical evolution of the number of FDPs: Nb FDP (n) = Nb volunteers year 1 x $3^{(n-1)}$; n being the year).

Fodders Demo-Plots enabled dairy farmers to produce and store 1,439 ± 657; 2,722 ± 1266; 1,410 ± 1,201 and 2,839 ± 1,611 kg MB/ha/FDP of forage for maize, sorghum, cowpea and mucuna respectively. Farmers produced and stored 1.135 ± 1.429; 2.028 ± 1.095; 2.184 ± 3.120; 13.217 ± 17.244 kg MB/ha/FDP fodder for maize, sorghum, cowpea and mucuna respectively. The forage produced by the farmers was sold or exchanged with dairy farmers to feed their cows. The main difficulties encountered were: (i) the lack of plots, which meant that certain crops were not planted, (ii) the difficulty of protecting plots from animals (fodder could not be mobilized for the dairy workshops) (iii) pockets of drought, termite and insect attacks.

Following the dynamic evolution of the FDPs and the lessons learned from the 2023/2024 experimentation campaign, a protocol was drawn up for the implementation of a OnEDA Upgraded (OnEDA-U) for this new 2024/2025 experimentation campaign. Co-design workshops were held in the Milk Collection Centers (MCC) with the initial volunteer farmers (Mothers) and potential Babies to validate this new protocol and train volunteer farmers.

2. Objectives and schedule of co-design workshops

Workshops were held at the following Milk Collection Centers: Farakoba, Dafinso, Satiri, Yégueresso, Bana, Bama, Belle Ville, Benkadi and Kouakoualé. The objectives were:

(i) Take stock of the quantities of seeds reserved by the Mothers ;

(ii) Present and validate the protocol for the 2024/2025 experimental campaign;

(iii) Identify Babies for the 2024/2025 experimental campaign and;

(iv) Training volunteers on technical itineraries and redistribution of seeds between Mothers and Babies.

To achieve these objectives, two main workshops were held (Table 1)

Table 1 Program of co-design workshops with farmers

Workshops	Date	Number of participants by CDC
Workshop to identify Babies, review reserved seeds and validate the protocol for the 2024 experimentation campaign.	May 29 to June 01, 2024	10 to 32
Training workshop on technical itineraries, signing of commitments and redistribution of seeds	June 18 to 23, 2024	9 to à 29

3. Workshops to launch the 2024 experimentation campaign

3.1. Update on seed quantities reserved by Mothers

All the Mothers took stock of the seed they had reserved. The quantity of seed reserved for maize was the highest. The total quantity of seed reserved by all MCCs was 1,019.6; 595.2; 218.4 and 613.2 Kg respectively for maize, sorghum, cowpea and mucuna (Table 2). Volunteer had difficulty obtaining and saving sorghum, cowpea and mucuna seeds. The difficulties mentioned were of several kinds: (i) difficulty in isolating FDP grain production from the farm's other crops; (ii) deterioration of reserved seeds by insects; (iii) failure to obtain grain due to late sowing, pockets of drought, termite and insect attacks, etc.; and (iv) consumption of the entire grain production.

Table 2 Quantity of seed reserved by voluntary farmers aggregated by MCC

MCC	Number of Mothers (G3)	Reserved corn seed (kg)	Sorghum seed reserved (kg)	Reserved cowpea seed (kg)	Mucuna seed reserved (kg)
Bama	10	164,4	241,8	59	119,8
Bana	6	33,6	50,4	1,8	4,3
Belle Ville	5	50,4	23,4	19,5	126
Benkadi	7	33	40	30,6	83
Dafinso	6	244	192,6	82,8	54
Farakoba	7	37,8	19,8	17,7	26,1
Kouakoualé	9	81	0	10	200
Satiri	5	57,6	23,6	6	0
Yégueresso	6	317,8	3,6	9	0
Total	61	1019,6	595,2	218,4	613,2

Source: Results of the Babies identification workshop, point of reserved seeds and validation of the protocol for the 2024 experimentation campaign.

3.2. Presentation of the protocol for the 2024/2025 trial campaign

Based on the lessons learnt in 2023, we have proposed An On-farm Experimental Design for Agroecology Upgraded (OnEDA-U) for this new experimental campaign (2024 - 2025). Thus, the 65 volunteer farmers known as mothers (Mothers) who set up the Fodder Demo-Plot in 2023 will each identify 2 new volunteer farmers, making a total of 130 farmers known as daughters (Babies) for the implementation of OnEDA-U (Figure 1). Given the large number of volunteer farmers planned for the 2024/2025 experimentation campaign (65 Mothers + 130 Babies), and with a view to good close monitoring, monitoring will focus mainly on 80 Babies and 40 Mothers (Figure 2). Three groups will thus be formed:

(i) Group 1: Research question: how to improve the 2023 OnEDA?

Group 1 will be made up of 40 Babies who will set up an OnEDA-U. OnEDA-U will consist of : 1) implementation of an improved forage and seed production system called Upgrade Fodder Demo-Plot (UFDP); 2) rational management of the farm's plant and animal co-products using the CoProdScope tool with 20 Babies ; 3) setting up Dairy Production Units using forage from the UFDPs and rationing advice using the Jabnde rationing tool; and 4) setting up Efficient Covered Manure Pits with monitoring of recycling of animal and plant by-products from production and use of organic manure. The crops for the UFDPs will be: cowpea KVX745 11-P, Mucuna pruriens var. deeringiana and Maize Espoir for the first group of 20 Babies, and cowpea KVX745 11-P, Mucuna pruriens var.deeringiana and Sorghum grinkan for the second group of 20 Babies. A total of 3 crops (2 legumes and

one cereal) per UFDP. Each crop will be planted on at least 0.125 ha, i.e. a total area of around 0.375 ha/UFDP to meet the shortage of plots. For each crop, 2/3 of the area will be dedicated to forage production and 1/3 to seed production. The seed produced will be divided into three equal parts: one part will be used to replicate the UFDP in year N+2, and the other two parts will be given free of charge to voluntary neighbors (known as "Babies") to set up the UFDP on their land in year N+2. Forage from the UFDP will be used to ration cows in the dry season (with rations calculated using the Jabnde rationing tool). Grass forage will be treated with urea before distribution to the animals. The treatment technique will be the subhumid technique (Ouattara et al., 2021). The 40 Babies will each install a manure pit with dimensions of 3m x 3m x 1m, i.e. a volume of 9 m^3 . The project coordination team will supply input for setting up OnEDA-U (tarpaulins, cement, seeds, urea, drums, watering cans, machetes). They will receive technical support from research and monitoring throughout the experimental period.

(ii) Group 2: Research question: how do the Babies manage the FDP?

Group 2 will also consist of 40 Babies called Babies Auto-Experimentateurs (BAE). The latter will receive inputs (seeds) from the Mothers to replicate the 2023 FDP. The seeds received will be sown on an average area of 0.125 ha per crop. For each species, 2/3 of the area will be dedicated to forage production and 1/3 to seed production. The seed produced will be divided into three equal parts: one part will be used to replicate the FDP in year N+2, and the other two parts will be given free of charge to neighbors who volunteer to set up the FDP on their land in year N+2. Seed support will be provided as needed. Light monitoring and technical support will be provided to observe the adoption of the BAE FDP.

(iii) Group 3: Research question: Do Mothers maintain practices on their own?

Group three will be made up of champion Mothers known as Self-Experimenting Mothers (SEMs). Forty (40) Mothers who have installed a covered manure pit will be identified. These MAEs will replicate the FDP with seeds reserved for this purpose. The *CoProdScope* tool will be used with the 10 Mothers for whom the farm-wide assessment and advice on co-product valorization have been carried out by 2023. This will make it possible to compare the results of the 2023 advice with the 2024 assessment and draw up the 2025 advice. The manure pits installed (pits installed in 2023) will be monitored until the organic manure has matured. Before emptying the compost from the pit, auger samples will be taken at five different points on the two diagonals of the pit, at depths of 0-30, 30-60 and 60-90 cm. Each depth will take an average sample for laboratory analysis and weed seed stock assessment.

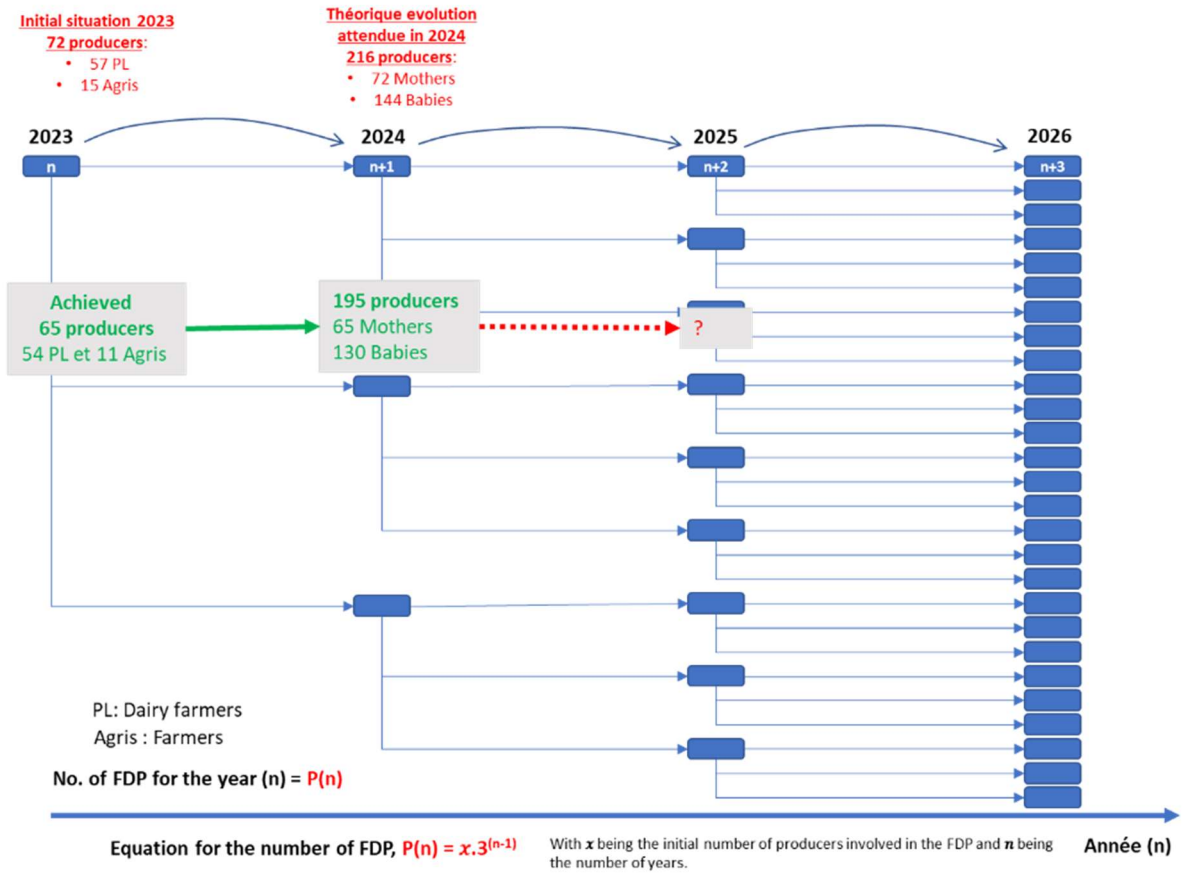

Figure 1 Theoretical evolution of FDPs from year to year (in French)

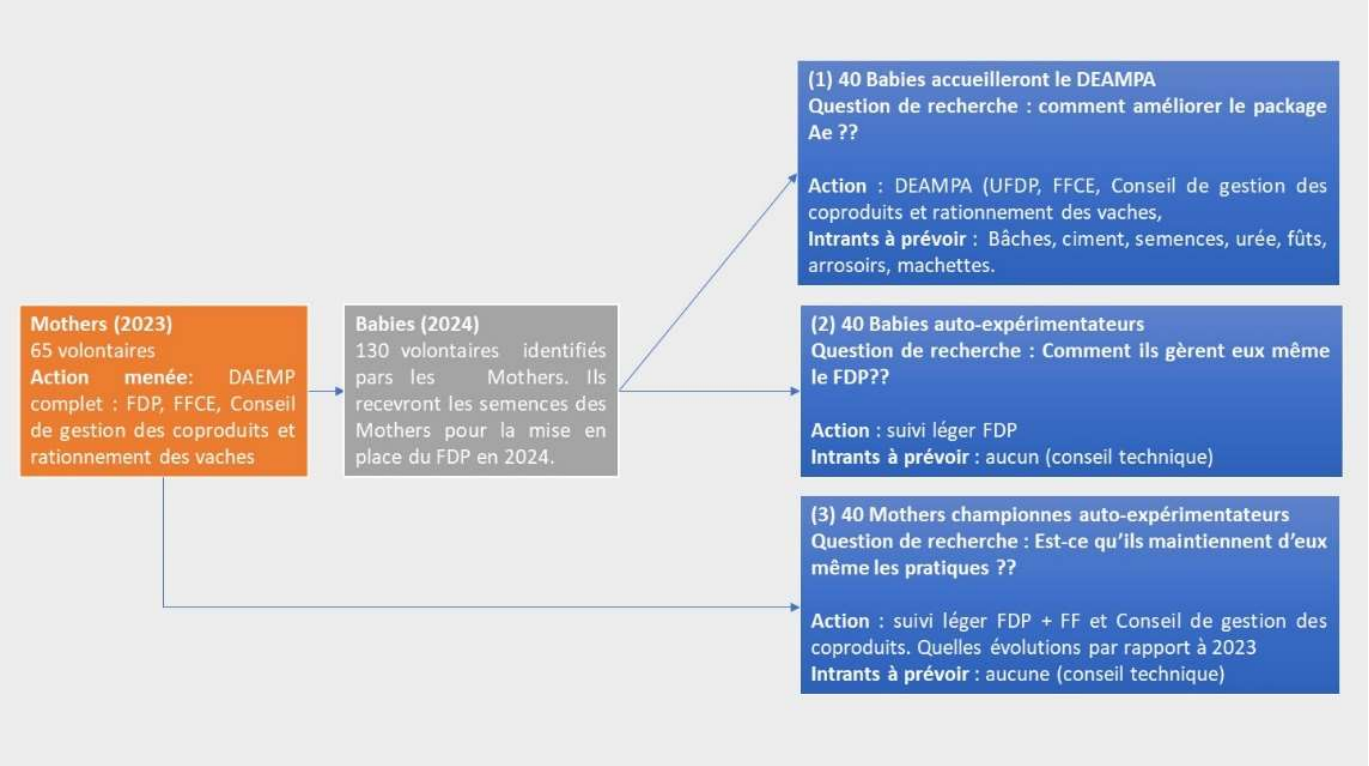

Figure 2 : Typology of farmers to be involved in setting up the Farmer Field Experimental System for the 2024 season (in French)

3.3. Validation of the protocol for the 2024/2025 trial campaign

After the presentation of the protocol for the 2024/2025 experimentation campaign, volunteer farmers (Mothers and Babies) amended the protocol with the following recommendations:

(1) Concerning Upgrades Fodders Demo-Plots (UFDP), they suggested keeping the 4 crops (maize, sorghum, cowpea and *mucuna*) from 2023, while leaving it up to the voluntary farmer to decide whether to plant all or some of the crops. Some suggested adding *pennisetum* and *brachiaria* to the four crops.
(2) 5 Mothers (farmers and dairy farmers) and Babies expressed their willingness to set up Efficient Covered Manure Pits if they received inputs.
(3) Concerning straw treatment with urea, some (very few) farmers were reluctant, but the majority were in favor.

The protocol was then validated, taking into account the following changes to the initial protocol: (i) farmers are free to choose between growing maize, sorghum, cowpea and mucuna; (ii) Mothers and Babies wishing to install efficient covered manure pits will receive the required equipment; and finally, (i) urea treatment of straw will be carried out on consenting farmers.

3.4. Identification of Babies for the 2024/2025 trial campaign

Babies pre-identified by the Mothers volunteered to join one of two groups of Babies. In particular, Group 1 (G1), which will set up an OnEDA-U, and Group 2 (G2) of Self-Experimenting Babies. The total number of Babies was 135, and the number of Mothers 62 (Table 3). Thirty-six (36) Babies (dairy farmers) volunteered to join Group 1 and 99 (63 dairy farmers and 36 farmers) to join Group 2. As for the Mothers, we recorded 3 who were on the move. However, they were allocated Babies by the other Mothers. We recorded a surplus of 5 Babies over the forecast of 130 Babies. Some Mothers identified more than 2 Babies.

Table 3 Distribution of volunteer farmers by experimental group

MCC	Mothers (G3)	Babies (G1)	Babies (G2)
Bama	10	7	21
Bana	6	4	9
Belle Ville	5	3	7
Benkadi	7	0	10
Dafinso	6	3	10
Farakoba	7	5	9
Kouakoualé	9	7	15
Satiri	5	4	8
Yégueresso	7	3	10
Total	62	36	99

Source: Results of the Babies identification workshop, point of reserved seeds and validation of the protocol for the 2024 experimentation campaign.
Legend: G1 = Babies who will set up the OnEDA-U ; G2 = Self-experimenting Babies; G3 = Mothers

4. Training on technical itineraries and volunteer commitments

4.1. Training on technical itineraries

All volunteer farmers were trained in plenary sessions on the technical itineraries for all forage crops. The training sessions were participatory. Mothers shared their experiences, highlighting the difficulties they had encountered:

- Late sowing contributed to grain failure, particularly in mucuna and sorghum
- Cowpea and sorghum emergence has been problematic on some farms
- Forage could not be harvested, as grain ripening occurred during the rainy season
- Forage could not be harvested due to lack of time and manpower
- Drought pockets; termite and insect attacks
- Difficulty protecting plots from animals

The data sheets for the four crops (maize, sorghum, cowpea and mucuna) were reviewed with the farmers.

4.1.1. Maize technical itinerary

In terms of soil preparation, farmers were advised to plough the land, ideally using animal traction, and to apply 5 t/ha of manure every two years. The usual sowing period is between June 1 and July 15, but in view of the weather warnings announcing delayed rainfall, farmers were alerted to this information and could therefore sow after July 15. Row spacing should be 80 cm and inter-bunch spacing 40 cm, with 2 seeds per bunch. The fertilizer doses to be used are 200 kg/ha of NPK in the 15th day after emergence. Urea doses should be 100 and 50 kg/ha on days 30 and 45^{e} respectively. (Sanou, 2006).

4.1.2. Technical itinerary Sorghum

Growers were advised to use ridging for soil preparation. Row spacing should be 75 cm and inter-bundle spacing 50 cm. However, to intensify fodder production, they could reduce row spacing and inter-bundle spacing. Sowing should occur after rain, with 2 to 3 seeds per poquet. Pockets should be shallow, and the seeds should be covered with a light layer of sand to facilitate germination. In terms of fertilizer, doses of 50 kg/ha of NPK at emergence and 50 kg/ha of urea 45 days after emergence should be applied. (Botorou and Niaba 2011).

4.1.3. Technical itinerary for cowpeas

Shallow ploughing was recommended for cowpeas, with an organic manure application rate of 2.5 t/ha/year. For mineral fertilizer, the recommended dose is 100kg/ha of NPK. To have forage that will be protected from the rains, sowing could take place between July 15 and early August. The row spacing should be 80 cm and the inter-bunch spacing 40 cm, with 2 seeds per bunch. Growers were asked to carry out two insecticide treatments respectively 35 days after the first sowing and 15 days after the 1er treatment (NAFASO, 2013).

4.1.4. Mucuna technical itinerary

For Mucuna, farmers were asked to prioritize clay, gravel and sand soils. Ploughing could be used, or direct seeding could be carried out. Sowing should be carried out at a rate of 2 seeds per poquet. Mucuna does not require fertilizer. However, quantities of organic manure and mineral fertilizers could be added to improve yields. (CIRAD-CIRDES-UPPCT-INADES, 2012a).

> “ NB: For all crops, farmers have been asked to keep their fields clean by weeding, especially when growing plants. In an insect attack, a suitable treatment must always be applied.

4.1.5. Forage harvesting and storage

For maize, sorghum and cowpea, farmers were asked to harvest the forage as soon as the seeds had matured, while the forage was still green, particularly on two-quarters of the plots. The remaining one-quarter is used for seed production. For mucuna, two quarters of the plot are harvested at the early flowering stage, and the remaining quarter is preserved for seed production. Harvested green fodder must be dried in the shade for a day, then stored away from termites and animals.

4.1.6. Covered manure pit technical itinerary

The manure pit should ideally be dug not far from the dairy workshops to facilitate its supply. It should be 1 to 1.20 m deep and 3 m long and wide, giving a volume of around 9 m^3 . The edges will be built with stones or cement bricks to stabilize the pit. The pit will be filled continuously, depending on the availability of plant and animal by-products. The pit will need to be watered, particularly in the dry season. Once filled, the pit will be covered with a tarpaulin to accelerate decomposition. (CIRAD-CIRDES-UPPCT-INADES, 2012b).

4.2. Signing of commitments and redistribution of seeds

After the training session on technical itineraries, the Babies (G1 and G2) signed the commitments. Once the commitments had been signed, the seeds were redistributed between Mothers and Babies. The Babies (G2) received the seeds from the Mothers. Some mothers who were unable to save seeds received seeds from other mothers. Surplus seed in the MCCs was mobilized to supply the MCCs with deficits. Babies (G1) received semen from the project coordination team. The semen deficit in Mothers (G3) and Babies (G2) was made up by the coordination team. The quantities of seed mobilized for the launch of the 2024-2025 experimental campaign are shown in Table 4.

Table 4 Quantity of seed mobilized for the launch of the 2024-2024 campaign

Seed origin	Quantity (kg)
Corn	
Mother seed	445,4
Support seed	127
Sorghum	
Mother seed	127
Support seed	219,2
Cowpea	
Mother seed	78
Support seed	251
Mucuna	
Mother seed	354,8
Support seed	295

Source: Results of the training workshop on technical itineraries, signature of commitments and redistribution of seeds.

4.3. Identification of voluntary farmers to be monitored in 2024

Thirty-six (36) Babies from group 1 and twenty-four (24) Babies (farmers) from group 2 will be rigorously monitored throughout the campaign to produce agronomic references. The farmers' fodder can be mobilized as needed in the dairy workshops. Forty (40) Babies (30 dairy farmers and 10 farmers) and 40 Mothers (30 dairy farmers and 10 farmers) will be monitored lightly. The 40 Babies and 40 Mothers were identified on the basis of having at least one legume in the 2024 Fodder Demo-Plot and an accessible farm. For the Mothers, we also took into account those who had performed well in the previous campaign. In other words, those who were able to produce seed and forage in 2023.

5. Conclusion

Workshops were held to present and validate the 2024-2025 experimentation campaign protocol, identify 135 Babies and take stock of the seeds initially reserved. The babies and mothers were then trained in the technical itineraries for growing maize, sorghum, cowpea, and mucuna and the technical itinerary for a manure pit. In all, 139 farmers received training. The Babies signed commitments and the seeds were then redistributed between Mothers and Babies. Generally speaking, the Mothers were able to produce seed. However, they were unable to store it properly. Seed support was provided to make up the shortfall, particularly in the case of legumes.

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7. Appendices

Figure 3 : Presentation of the 2024-2025 experimental protocol

Figure 4: Training session on technical itineraries

Figure 5: Redistribution of semen between Mothers and Babies

Figure 6 Family photo after the training session at the Kouakoualé milk collection center

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